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AGRONOMIC ADVANCES IN THE AGRICULTURE OF THE CORN BELT AND THE GREAT PLAINS REGIONS[1]

By Dr. H. K. WILSON[2]

MINNESOTA AGRICULTURAL EXPERIMENT STATION

THE topic assigned to me presents several obvious problems, the chief of which is to cover the subject adequately within the allotted time without too many omissions of worthy contributions. Any failure to include important phases of work must be charged to the speaker in his inability to properly deal with this wealth of material within the short space of 30 minutes.

There has been one extremely outstanding development in the agronomic work of this region, of such vital importance, and with results so significant that it deserves special emphasis. The greatest single accomplishment of the past 25 years has been the evolution of a degree of cooperative research effort that has made this quarter of a century a period of unusual advancement. The close relationships between the United States Department of Agriculture and the various state experiment stations have unified the research toward common goals. Free exchange of ideas and materials is an established practice and is aiding greatly in promoting scientific agriculture.

Federal workers have aided in many phases of regional coordination. Generally, the United States De-

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[2] Agronomist, Division of Agronomy and Plant Genetics, Minnesota Agricultural Experiment Station. The author wishes to acknowledge with thanks the helpful suggestions and criticisms of Dr. H. K. Hayes, chief of the Division of Agronomy and Plant Genetics. Dr. L. F. Graber, Wisconsin Agricultural Experiment Station, and Professor R. I. Throckmorton, of the Kansas Agricultural Experiment Station, made valuable suggestions for which thanks are given.

partment of Agriculture has not developed experiment stations in the individual states but has furnished some regional research workers who often make their headquarters at the state experiment stations. It is common for these federal workers to be accepted on the same basis as the state workers with equal rights and privileges of action. Naturally such state and federal programs would fail without the necessary cooperation between research workers to make regional coordination possible.

Before proceeding further in a discussion of cooperation it should be made clear that not all the work has been done by the agronomist. The breeding of improved crop varieties brings to attention the importance of plant diseases and the plant breeder and the plant pathologist have cooperated closely in the development of new varieties. The breeding of wheat will illustrate the principles involved. The plant breeder is primarily responsible for deciding which crosses to make and the breeding methods to be followed while the pathologist leads in the creation of the epiphytotic. Selections are made under disease conditions and the two phases of improvement are dovetailed, one with the other. More and more attention is being given to quality studies and the cereal technologist joins in the cooperation to conduct the various milling and baking studies using the material from the breeding plots for his investigations. Finally, the agronomist, the pathologist, and the cereal technologist study the assembled data and reach a joint conclusion as to the suitability for release of any new varieties that may have been produced.

In some cases the soils worker enters into the cooperation in the testing of the varieties under different soil conditions and in response to varying levels of fertility. It would appear that this phase of investigation merits greater study than has generally been given it in the past, as promising results have been obtained at several stations.

Cooperative wheat research between the United States Department of Agriculture and the Minnesota Agricultural Experiment Station was initiated in 1907. From this early work there developed the regional conference where research workers meet to discuss their mutual problems. Similar conferences are held in the hard red and soft red winter wheat states. These conferences have done much to further the advancement of the improvement programs.

In the hard red spring wheat area black stem rust threatened the extinction of wheat growing in many sections. Thatcher wheat, a cooperative development of the United States Department of Agriculture and the Minnesota Agricultural Experiment Station, was introduced in 1934. In 1941, Clark estimated that 18,000,000 acres of Thatcher were grown in the United States and Canada. W. C. Helm, president of the National Millers Federation, states, "Thatcher wheat was a God-send to the Northwest." Disease epidemics often make it necessary to replace existing varieties. Because of severe epidemics of leaf rust, Thatcher wheat is being replaced by other more satisfactory varieties most of which are resistant to both stem and leaf rust. Many promising new strains are under test in the various experiment stations.

In the spring wheat region durum wheats are of considerable importance and recently Carleton and Stewart, two rust resistant, high quality macaroni varieties, were released to farmers of the durum area.

In the hard red winter wheat region much progress has been made as a result of cooperative effort. Two new varieties of promise are Comanche and Pawnee.

In the improvement of wheat varieties there has been a significant tie-up with the milling interests. In the spring wheat area the Northwest Crop Improvement Association has made possible the cooperation of the milling interests in the testing of new lines of spring wheat in sufficiently large plots to provide flour for experimental trials by the large commercial mills. Under this arrangement new varieties are tested by the millers in their own experimental laboratories. When all results are tabulated, representatives of the laboratories meet with the research workers and free and frank discussions follow. These relationships have broken down the suspicions and the lack of understanding that may have existed between the two groups of interest. The result of this arrangement has been to rapidly advance the spring wheat improvement program. The Southwest Crop Improvement Association is carrying on a similar type of program in the hard red winter wheat area and the coordinated breeding program is benefiting greatly. It is significant that the processors of wheat and other crops have come to realize the need for research in the betterment of crop varieties.

Workers in the soft red winter wheat area are concerned with problems of disease resistance, winter hardiness, and quality improvement. The Soft Wheat Breeding Conference is furthering cooperative research in much the same manner as in the hard red spring and winter wheat states.

Previous to the placing of corn improvement on a definite cooperative basis much progress had been made by individual workers. Several of the corn-producing states were carrying on a breeding program under the leadership of F. D. Richey, who was in charge of corn improvement in the Division of Cereal Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture. There existed a spirit of cooperation and several regional meetings

had been held to discuss mutual corn breeding problems. In 1925, the directors of the Corn Belt experiment stations accepted corn improvement as a major regional program under the Purnell Act which made new funds available for special phases of agricultural research. A special corn committee outlined a plan of corn improvement under the Purnell Act and this program was published in the *Journal* of the American Society of Agronomy in September, 1926. The program proposed outlined in a broad, direct manner the needed investigations. The following recommendation is quoted from this report:

> The committee feels that everything possible should be done to promote this personal cooperation, as this appears to be the best method of coordinating the program as a whole. With this in mind they recommend strongly that travel, necessary to an annual conference of the workers interested, be recognized as an integral part of the program and that specific provision for such travel be budgeted out of Purnell funds.
>
> At such meetings, a report of the season's investigations should be presented and discussed. Contemplated new research should be outlined. This would provide for voluntary cooperation and coordination.

How successful this voluntary corn improvement cooperation has been is known to layman and scientist as well, as hybrid corn today marks one of the greatest accomplishments of agricultural research. According to a recent article in *Life* magazine, hybrid varieties were responsible for an increase in the U. S. of 629,000,000 bushels of corn last year. During the present war emergency with the added demands for increased production, consider the great significance of such an increase. The Bureau of Agricultural Economics of the United States Department of Agriculture estimated that, in 1943 in the 12 corn belt states of Iowa, Ohio, Indiana, Illinois, Wisconsin, Minnesota, Michigan, North and South Dakota, Nebraska, Kansas and Missouri, more than 78 per cent. of the corn planted was of hybrid varieties. Beyond a doubt the time is near when the old open-pollinated varieties will no longer be grown commercially and every corn farmer will grow hybrid varieties. It should be noted that the corn workers have made the necessary plans to maintain seed supplies of all important open-pollinated varieties as a constant source of the germ plasm they provide.

Waxy corn once looked upon as a genetic curiosity can be used to replace tapioca and to otherwise serve in the manufacture of adhesives. The new variety Waxy Iowa Hybrid 939 developed cooperatively by the Bureau of Plant Industry and the Iowa Agricultural Experiment Station appears very promising. Tests have shown it to be a satisfactory substitute for tapioca with many people unable to distinguish between commercial tapioca and the waxy corn product when the two kinds are made into puddings. In some cases, preference was shown for the corn product. Since our annual imports of tapioca have averaged about 350,000,000 pounds, with most of the supply coming from the Dutch East Indies, it is apparent that waxy corn offers a product of great value. It is believed that by 1945, the supply of first generation hybrid seed will be sufficient to provide for food needs as well as for the manufacture of adhesives.

The oat crop provides another illustration of cooperative advance, with the United States Department of Agriculture cooperating with the workers in all important oat producing regions of the United States in the greatest impetus in oat improvement in our history. Crossing Victoria with Richland resulted in high yielding, strong-strawed varieties which are resistant to both black stem and crown rust and to the smuts. The Wisconsin Station has released the variety Vicland; Iowa, the varieties Tama, Boone and Control; Nebraska, the variety Cedar, and South Dakota, Vikota, all having come from unified efforts in oat improvement.

These varieties have been accepted by the farmers with open arms and the demand for seed has exceeded the supply. According to Dr. L. F. Graber, of the Wisconsin Agricultural Experiment Station, from the original distribution of Vicland in 1941, there were at least 1,000,000 acres grown in Wisconsin in 1943 and he expects that of the two and one-quarter million acres of oats grown in Wisconsin in 1944, 1,500,000 acres will be seeded to Vicland. This represents a most unusual acceptance of a new variety within a short period of 2 to 3 years.

Smooth awn barley varieties gave an added stimulus to barley production in the Corn Belt states. The barley breeder must keep in mind two important objectives, suitability as a feed type and for malting purposes. At present with the help of the malting interests varieties are tested at the Malting Research Laboratory, University of Wisconsin, to determine their probable malting value. This work is making for more adequate testing of new lines resulting from barley breeding and is another illustration of the closer relationships between industry and the research workers.

For many years the flax breeders have worked closely with the industrial users of flax products. Since the early twenties, the Flax Development Committee of the Flax Institute of the United States has subsidized the research of the flax breeders and each year this committee has underwritten the expenses of a regional conference where the research data are presented for discussion. The industrial workers have given their side of the picture, their problems

and needs and the mutual relationships have led to a splendid appreciation on the part of the industry and the agronomist alike of the value of mutual interdependence.

To-day the flax breeder strives to produce disease resistant, high yield varieties with a high percentage of oil of superior drying qualities. Recent examples of the effectiveness of this program of research are the varieties Crystal and Koto. Crystal produced by the Minnesota Station and the United States Department of Agriculture is immune from races of rust common in the United States, is resistant to wilt, and its seed yields a high percentage of oil of good drying quality. Koto, developed cooperatively by federal workers in the North Dakota Station, is a high yielding wilt resistant variety, which while not pure for resistance to rust, has not been injured appreciably under severe rust conditions. Both Crystal and Koto will be distributed to growers for planting in 1944.

In the Southwest the development of combine types of grain sorghums has been of significance. These shorter stalked varieties have reduced labor requirements and have made it possible for the farmers of that region to maintain a reasonable acreage of grain sorghums during the present shortage of labor and farm equipment.

Sorghum varieties with waxy seeds, of similar use to waxy corn, offer possibilities as the starch may be used to substitute for the cassava starch of industry. Waxy kafir, developed at Lubbock, Texas, and Waxy Club at the Hays, Kansas, station are two varieties that have proved promising.

The soybean was introduced from the Orient many years ago but for a long period of time it was of relatively little importance. Much credit must be given to the agronomist for his studies in the methods of growing, harvesting, and utilization of the soybean. Without this ground-work the crop could never have attained its present importance. With the added impetus of the war, the soybean is a major crop in the Corn Belt. For the years 1927–31, soybean for seed acreage averaged 1,114,000 yearly with a production of 15,845,000 bushels. In 1942 the acreage was 10,762,000 with a production of 209,559,000 bushels, an increase of nearly 1400%. The October 1 estimates indicate a production nearly as great in 1943. Consider the significance of the development of soybean production in the light of our present war needs for fats and oils, and the ever expanding uses in industry of which the plastics are a notable example.

The soybean is coming to the front as a food plant. Our armies are using millions of pounds of soybean flour. Scientists have developed edible varieties of soybeans and its use as a green vegetable is becoming popular. A considerable quantity of green soybeans was packed by the canners in 1943 and the crop was found in not a few Victory gardens. As its value becomes better known we may expect the soybean to become one of our important vegetable crops. Those who have eaten properly prepared soybeans predict a great future for this plant which has long been a principal food product of the Chinese.

Various types of soybean flour processed by the miller are finding favor with the most exacting of cooks. The present war probably will stimulate the use of soybean products as natural prejudices are broken down under the stern demands of necessity.

Turning our attention to the forages we find further striking developments. Probably no other forage has shown such a complete shift in its center of production as alfalfa. In 1899 only about 2 per cent. of the alfalfa acreage of the country was in the north central states. In 1919, this percentage had risen to 10.4 per cent.; in 1929, to 25 per cent.; in 1939, to 45.4 per cent., the approximate relationship at the present time. It is interesting to note that today the four leading alfalfa states in order of acreage are Minnesota, Michigan, Wisconsin, and Iowa. In 1943, these four states produced approximately 39 per cent. of all the alfalfa hay produced in the United States.

Wendelin Grimm, the German emigrant to Minnesota, must be given much credit for the increase of alfalfa acreage in the north central states. However, without the experiment stations to test the variety and to prove its place, Grimm alfalfa probably would never have reached its place of importance. As with other crops previously mentioned, cooperation has had its part with the federal and state workers testing promising strains. To-day, Grimm alfalfa is rapidly on the way out because of its susceptibility to wilt. New desirable varieties of promise are Ladak, Ranger, and Buffalo. Ladak, a winter hardy variety introduced by the United States Department of Agriculture from India, is fairly resistant to wilt and in Minnesota has proved more persistent than Grimm. Ranger and Buffalo, wilt resistant varieties developed at the Nebraska and Kansas stations, respectively, in cooperation with the United States Department of Agriculture, are wilt resistant and otherwise generally satisfactory producers.

In connection with alfalfa production one must not overlook the splendid contributions on time and methods of harvest and other agronomic questions as related to the maintenance of stand. These investigations are largely responsible for the shift of alfalfa acreage to the north central states and for making alfalfa one of the most profitable of crops.

A striking development in crop change has been the introduction and distribution of Korean lespedeza. This plant with its ability to grow on the acid soils

of the more humid and milder temperature areas of the middle west has been a life saver for many farmers. The ability of the crop to reseed itself has led to many changes in rotations as has been so well demonstrated by the Missouri Agricultural Experiment Station. Lespedeza is of especial value in those sections where alfalfa is not adapted.

Sweet clover from the position of a weed of no value has come to be an important hay and pasture crop. In some regions it is tending to lose its popularity and to be replaced by other clovers. The production of varieties which will remain leafy over a longer period of time is one of the major problems. The coumarin content of sweet clover and its relationship to crop utilization is being investigated by some workers.

Recently registered new sweet clovers, as reported by Hollowell, are Spanish and Evergreen of the *alba* species and Madrid, an *officinalis* variety. Spanish, introduced from Madrid, Spain, is adapted to the Corn Belt, Great Plains, and the intermountain states. Evergreen was selected at the Ohio station and is adapted to the Corn Belt and the eastern edge of the Great Plains states. Madrid, the yellow flowered variety introduced from Madrid, Spain, possesses early seedling vigor, and resistance to fall frost. Its earliness permits it to escape the drouth common during the summer months in the Great Plains.

The United States Department of Agriculture is cooperating with several state agricultural experiment stations in the improvement of red clover. Two recently registered varieties are Cumberland and Midland. Cumberland, resistant to southern anthracnose and crown rot, is adapted to the southern region of the principal red clover belt. About 120,000 pounds of certified seed were produced in 1942. Midland, a winter hardy variety with some resistance to northern anthracnose, is adapted to the middle or central part of the Corn Belt. Some 220,000 pounds of certified seed were available for planting in 1943.

Crested wheat grass is a popular forage plant in the northern Great Plains area, where its ability to grow under the very dry conditions of that part of the country led to its increased usage as a hay and pasture grass. Professor R. I. Throckmorton, Kansas Agricultural Experiment Station, in a letter states:

> The introduction, distribution, and use of crested wheat grass in the Northern Plains has added enormously to the value of millions of acres of land. In this connection I found in August through a survey that approximately 3 million acres of land have been returned to grass in the Great Plains during the last 10 years through natural reseeding and that a like acreage has been returned to grass through artificial seeding. In other words, approximately 6 million acres of cultivated land in the Great Plains have been returned to grass during the last 10 years. Most of this took place since 1938.

In the Plains region there have been developed new methods of harvesting seed and in the reseeding of native grasses, as buffalo, grama, and the bluestems, returning these areas unsuitable for cultivation to grass where they may be expected to yield a maximum of grazing value. In a relatively short time much has been done to repair the damage that was done from placing these lands in cultivation with the accompanying erosion and destruction of native stands of grass. It is impossible to adequately estimate the monetary value to the nation of the reclamation of these grass ranges.

Smooth brome grass was usually considered as a weedy grass until it was shown that it could qualify as a meadow and pasture grass. Today it is frequently grown in combination with alfalfa to provide a suitable hay and pasture mixture. The agronomist is breeding for greater disease resistance and finer quality of forage with considerable promise of success as improved types are under test at several of the grass breeding stations. The growing of mixtures of alfalfa and other legumes with suitable grasses is an accepted practice proving of great value for rotational pastures and hay crops.

Reed Canary grass, while localized in the more northern states, is another example of the utilization of a wild grass for the benefit of agriculture, as it is a plant capable of growing on certain types of peat soil that are wet a part of the year. Since its introduction much marginal land has been reclaimed and has taken its place in increasing the acreage of productive farm lands.

The rather worn-out phrase of pastures being exercise grounds for livestock is still appropriate to portray the situation on many farms. The necessary research information is available so that such a condition need no longer exist. Within recent years added attention has been given to our pastures both temporary and permanent as investigators have learned how to increase pasture yields by proper renovation methods and grazing practices which make for high production. Probably no other farm enterprise is so little appreciated by the average farmer as his pasture. This viewpoint is changing rapidly as the research and extension workers demonstrate the possibilities of good pasture management.

Under war conditions the sugar beet is of added importance. There has been significant improvement in adaptability to specific conditions and resistance to the principal disease (Cercospora leaf spot) limiting production east of the Continental Divide. Great advances have been made in the substitution of the machine for hand labor in the growing of sugar beets and sugar beet workers believe that complete mechanization of sugar beet production is in sight.

A new phase related to our present war emergency

is the growing of the Russian dandelion (*Taraxacum kok-saghyz*), a cousin to our common dandelion, for the production of natural rubber. Trials are being made by federal workers in cooperation with the state agricultural experiment stations. Numerous problems of germination, seed storage, seed and root harvest, and the combatting of diseases and weeds occupy the time of the investigators as practically nothing was known about the culture of the crop when the work was initiated in America a little more than a year ago.

Our present acute shortage of fibers made it essential for several of the states to cultivate hemp as a fiber plant. As with milkweed, in some areas, the plant is shifted from its former position of an undesirable weed to that of an economic crop. In Wisconsin the hemp industry has operated for many years and agronomists were able to provide the necessary information to enable farmers in other areas to produce a new crop about which they knew little or nothing.

Before the present war paper was imported from Europe for the manufacture of cigarette paper. With the supply of paper shut off, industry looking for a substitute turned to the use of flax straw fibers, and to-day we find a new industry built on this need. The paper processors, cognizant of the need for superior varieties of flax and suitable supplies of weed free straw are providing funds for research and otherwise cooperating with the agronomists toward these goals. Formerly farmers who made a regular practice of burning their flax straw now find it profitable to grow a clean crop and through the sale of the straw, augment their financial returns from the crop. The straw from some 300,000 acres of flax finds a ready market each year.

Using the State of Minnesota as an example, Dr. C. O. Rost, Minnesota Agricultural Experiment Station, states:

> At present, in our state, an amount of fertility equivalent to at least 500,000 tons of commercial fertilizer is removed annually by potatoes, sugar beets, grains, livestock and livestock products. This represents fertility which leaves the farm. Our farmers are replacing only 1/10 of this amount of plant nutrients. It is clear that this practice cannot be continued indefinitely. The situation in Minnesota is typical of the 5 states which have within their borders 70% of the excellent and good crop land of the United States.

The increased use of commercial fertilizers has aided many farmers to grow profitable crops. In general, the farmers of the Corn Belt and the Great Plains Area have been slow to use commercial fertilizers. In part this was due to their being blessed with inherently fertile soils. Years of crop mining have changed the picture. Soil scientists have proved the value of commercial fertilizers and in many cases their use has proved the difference between a profit and a loss. For this region the end is not in sight as the surface has but been scratched and we may expect commercial fertilizers to be used almost universally in the near future.

Research on the insect problems has received attention at some of the stations. Progress to date indicates that much may be done to control insects through the breeding of varieties resistant to their damage, although agronomists and entomologists have developed farm practices essential in the control of most insects.

No discussion of crop research advances would be complete without giving some attention to those plants which persist in growing where they are not wanted. The weed research program, another example of unified research, was started in 1935, when the United States Department of Agriculture entered into a cooperative program of attack on the control of field bindweed. Regional cooperation in this area included the agricultural experiment stations of Kansas, Nebraska, Iowa, and Minnesota. All efforts were pooled and a series of uniform experiments was conducted at each station.

The weed program has given results which could not have been obtained by the states working alone. For example, root analyses for all stations were made at Ames, Iowa, making possible a standard, uniform procedure. Regional conferences of the workers from the federal and state agencies have led to revisions of research, improved methods of attack, a unification of effort and the drawing of conclusions that have solved many of the weed problems.

The weed research has shown that weedy plants can be controlled and eradicated without paying a tax so great that the farmer could not afford to cope with the situation. The use of cropping methods in connection with proper cultivation has made it possible for farmers to gain returns from their farms while carrying on an intensive eradication program.

Studies of the physiology of the weed have led to farm practices which are most effective in reducing its vigor and affording desirable crop plants a better opportunity to compete. To-day a good farmer may purchase a farm infested with field bindweed while 10 years ago he would not have considered such a farm.

The examples given represent but a cross section of developments and many more illustrations could be given if time permitted. Nearly every experiment station is short-handed and the pressure for information is very great. It is believed important that agronomists should not lose sight of the significant

values obtaining from long time research problems because of the pressure for quick, so-called practical results. If a shift is made and is carried too far, great losses are certain to occur and all should plan to carry on or to resume their activities in fundamental research just as soon as humanly possible.

OBITUARY

HARRIS HANCOCK

ON March 16, 1944, Harris Hancock, professor emeritus of mathematics of the University of Cincinnati, died at his home in Charlottesville, Va. A scant dozen miles away is Ellerslie, the ancestral Hancock home; here he was born seventy-seven years ago, the son of Richard Johnston Hancock and Thomasia Harris Hancock. After attending the University of Virginia and the Johns Hopkins University, where he received his A.B. in 1891, he went abroad to study with eminent British, German and French mathematicians. At Cambridge he studied with Cayley, Forsyth, Glaisher and J. J. Thomson. In Germany, at the University of Berlin, he attended the lectures of Fuchs, Frobenius, Kronecker and Schwartz. Here he was profoundly influenced by the lectures of Schwartz on the theories of his great teacher, Carl Weierstrass, one of the most subtle and penetrating critics of mathematical rigor and logic. After receiving the doctorate in philosophy from Berlin in 1894, he proceeded to Paris, where at the Sorbonne, he studied under Darboux, Picard and Poincaré, a triumvirate whose writings and researches form a rich legacy for geometry and analysis. At Paris he was awarded the degree of doctor of science.

Returning to the United States, he taught at the University of Chicago for six years. In 1900 he came to the University of Cincinnati as the head of the department of mathematics. Here he began work on a series of books over the fields of mathematics to which he had given his principal attention, while in Europe. His first two volumes, on "Maxima and Minima" and "The Calculus of Variations," were founded on the lectures of Weierstrass and helped to familiarize American mathematicians with the work of this great savant. Both volumes were published by the University of Cincinnati Press; the first indeed was edited by President Howard Ayres, who was presumably a confirmed Weierstrassian. These were followed by his books on "Elliptic Functions" and "Elliptic Integrals," both published by the house of Wiley. The work on "Elliptic Functions" was planned on a heroic scale as a three-volume treatise. Only the first volume, on "Analysis," of some five hundred pages, was published in full. The second, which was originally designed to cover the entire gamut of applications, was finally scaled down to form a monograph on "Elliptic Integrals." The third volume, on "General Arithmetic and Higher Algebra," was never published in its original form. But parts of this volume were presumably incorporated into the next of Dr. Hancock's books, a two-volume treatise, of some 1,250 pages, on the "Foundation of the Theory of Algebraic Numbers." This work was published by Macmillan with the aid of the Charles Phelps Taft Memorial Fund. As a sequel to this work, he finally brought out in 1939, two years after his retirement, his "Developments of the Minkowski Geometry of Numbers," also published by Macmillan and with the aid of the Taft fund.

These books brought to the American mathematical public the researches of foreign mathematicians in a more digestible form than that offered by the professional periodicals of the time. Hancock had access to Weierstrass' lectures in the Mathematischen Verein in Berlin; and his bringing these lectures to America, first in a series of abstracts in the *Annals of Mathematics,* and later in his books, he performed a great service for American mathematics. He had, too, the gift of clear exposition; he was never hurried, either in his writing or his lectures. At his own good time, the argument marched on to an inevitable and satisfactory conclusion.

It must surely be a matter of amazement that Harris Hancock, so unhurried, so deliberate, could have accomplished such a vast amount of important work in his lifetime. Apparently he was never very busy. Indeed he was always ready to give friendly advice and assistance to his students, to tell a good darky story, to discuss the culture of roses or the breeding of fine horses. In his classroom he adopted the principle stated so well by Nevin Fenneman: "Primary education should develop your weak points; university education your strong." The stupid, the slothful, the indifferent, he left to sleep in peace. But if you showed a spark of interest in mathematics, a gleam of ability, you were a marked man thereafter. He worked the able student constantly and unmercifully until he was finally delivering complete lectures.

Dr. Hancock's good students loved him; and even the poor and indifferent respected his ability and ease in the realm of mathematics. To many of his students, especially the engineers, he was known as the "Handy Man"; whenever a problem arrived at some seeming impasse, he had always a handy transformation that would save the day. They were baffled and amused by his southern pronunciation; and they all looked forward to Derby Day as a national holiday

from the Calculus—for then the "Handy Man" betook himself to Churchhill Downs.

Harris Hancock was by no means exclusively concerned with advanced mathematics. He was vitally interested for many years in mathematics at the high-school level. He wished to maintain good standards of elementary instruction. He insisted that teachers of mathematics must first learn the subject—not only methods of teaching mathematics, but also its rich and diverse content. In a series of articles in *School and Society* from 1915 to 1920 he set forth his views in no uncertain terms. More important still, he built up through his courses for teachers a devoted group of men and women who gave their pupils in the high schools a firm foundation for more advanced work.

As Mrs. Hancock wrote a few days ago: "He had lived a full and happy life; and had accomplished a great amount of work which will live. We have so much to comfort us, but the parting is hard." It is hard for us too; we shall miss the big, kindly man in a derby hat for so long a familiar figure on the campus.

And now the layman, to whom mathematics is a drear and arid subject, may well wonder: "Why did this man, so human, so kind, so capable of piloting his life into this or that channel, why did he choose to spend his energies, his very life-blood, in writing in the most abstruse of fields for a mere handful of readers?" Perhaps the answer is given by the English physical chemist, F. G. Donnan: "The power of rigorous deductive logic in the hands of a mathematician of insight and imagination has always been one of the greatest aids in man's effort to understand that mysterious universe in which he lives. Without the presence of this power, the experimental discoverer might wander in the fields and pick the wild flowers of knowledge, but there would be no beautiful garden of understanding wherein the mind of man can find a serene delight."

LOUIS BRAND
UNIVERSITY OF CINCINNATI

CHANCEY JUDAY

ON March 29, 1944, science lost its foremost limnologist. Dr. Juday contributed, individually or as a joint author, almost a hundred limnological papers of outstanding merit. Many young limnologists were trained and stimulated by him. He served for two years as the first president of the Limnological Society of America. In 1943 the Academy of Sciences of Philadelphia awarded him their Leidy Medal. Dr. Juday was president of the American Microscopical Society (1923) and of the Ecological Society of America (1927). He was also secretary of the Wisconsin Academy of Sciences (1922–1930) and then president, a member of the American Association for the Advancement of Science, American Society of Naturalists, American Society of Zoologists, International Limnologists, Phi Beta Kappa and Sigma Xi.

Dr. Juday was born on a farm near Millersburg, Indiana, on May 5, 1871, and was therefore seventy-two years old at the time of his death. He attended the University of Indiana and received his A.B. (1896), A.M. (1897) and LL.D. (1933) degrees from that institution. Then he taught in an Indiana high school for two years (1898–1900), served as biologist for the Wisconsin Natural History Survey for a year (1903–04), was acting professor of biology in the University of Colorado (1903–04), and instructor in zoology in the University of California (1904–05). In 1905 he returned to Wisconsin and was a member of the Natural History Survey until 1941, when he retired. He was made a lecturer in the University of Wisconsin in 1908, professor of limnology in 1931 and director of the Trout Lake Limnological Laboratory in 1925.

Dr. Juday published papers on the lakes of Indiana, Colorado, California, Central America, New York and other localities. Among his eminent contributions are those to the understanding of plankton migrations, the significance of dissolved gases in lakes, chemistry of lake waters, growth of lake animals, lake populations and the productivity of lakes. Dr. Juday was an example to all who knew him of a high-class gentleman—thoughtful, competent, helpful, industrious, modest and responsible. Though in early life he was obliged on two occasions to rest for a time in a tuberculosis sanitarium, he kept on with his limnological work without asking favors or special consideration from his fellows. He was a brave lad!

Dr. Juday is survived by his good wife, Magdalen Evans; two sons, Major C. E. and Dr. R. E.; a daughter, Mary; a sister, Mrs. Ada Wehrley; and two grandchildren.

A. S. PEARSE

DEATHS AND MEMORIALS

DR. HARRY FIELDING REID, professor emeritus of dynamic geology and geography of the Johns Hopkins University, died on June 18. He was seventy-five years old.

DR. HERBERT A. CLARK, founder and head of the standards laboratory of the Taylor Instrument Companies, Rochester, N. Y., died on April 20.

DR. MORTON C. MOTT-SMITH, staff writer for physics and chemistry of Science Service, Washington, D. C., died on June 9 at the age of sixty-six years.

Nature writes: "Past and present students of the department of zoology of University College, Cardiff,

have opened a Tattersall Memorial Fund, the object of which is to found a studentship in zoology in the college as a memorial to the late Professor W. M. Tattersall, who died on October 5, 1943. The organizers of the fund also desire to invite the many friends of Professor Tattersall, particularly zoologists, in various parts of the world, to join them in perpetuating his memory. Information may be had from G. E. H. Foxon, who is acting as the honorary secretary and treasurer of the fund, at the Department of Zoology, University College, Newport Road, Cardiff, and to whom donations should be sent."

SCIENTIFIC EVENTS

AGRICULTURE IN GREAT BRITAIN

IT is reported in *The Times*, London, that an agreed policy, endorsed by representatives of all sections of British agricultural interests, was adopted unanimously on May 5 at a conference at the headquarters of the Royal Agricultural Society, with Sir George Courthope, M.P., president of the society, in the chair.

The organizations represented were the Royal Agricultural Society of England, the National Farmers' Union, the Group of Peers, the Councils of Agriculture for England and Wales, the Central Landowners' Association, Transport and General Workers' Union, Land Union, Chartered Surveyors' Institution, Land Agents' Society and the Land Settlement Association.

The following draft of principles was accepted by the conference:

The fundamental purpose of a long-term policy should be the proper use and management of the agricultural land of the country for the production of the foodstuffs which it is best fitted to provide and which are most required to satisfy nutritional needs, while maintaining the fertility of the soil, the raising of the standards of rural life and the increase in the rural population.

It is essential on national grounds that British agriculture should be maintained in a healthy condition, sufficiently prosperous to ensure a stable level of prices which will yield a reasonable return to the producer and on the capital employed in the industry, and a scale of wages sufficient to secure a standard of living comparable to that of urban workers. There should be a definite relation between the price level and the costs of production.

Mixed farming should be encouraged in order to ensure soil fertility and regular employment throughout the year.

International and Imperial cooperation must be secured in the orderly regulation of production and marketing, as proposed in the report of the Hot Springs Conference.

A statutory body was recommended to continue the functions of the Ministry of Food in regard to the importation and marketing of competitive foodstuffs, supported by an Imports Board; and in return for a guaranteed price level all owners and occupiers of rural land must accept an obligation to maintain a reasonable standard of good husbandry and good estate management and submit to direction and guidance, subject to appeal.

Other proposals related to the expansion of agricultural education and research, opportunities for advancement within the industry, taxation "such as will make it possible to plough back into the industry capital necessary for the provision and upkeep of movable equipment," adequate credit facilities on terms equally favorable to those enjoyed by other industries, the provision of machinery for farmers and small-holders on reasonable terms, good houses for agricultural workers at economic rents, the extension to rural districts of water supplies, improved sanitation, gas or electricity, the overhaul of the administrative machinery of land drainage and the recognition of the maintenance of sea walls and defenses as a national charge.

THE NATIONAL COMMISSION OF SCIENCE TEACHING

As reported in SCIENCE for May 12, the sixth annual summer conference of the New England Association of Chemistry Teachers will be held from Thursday afternoon, August 24, to Monday afternoon, August 28, during the summer session of the Connecticut College at New London. In this connection, *The Journal of Chemical Education* reports that at an informal meeting of the National Commission of Science Teaching, held in New York City on March 19, the following organizations had named official representatives to the commission: The New York City Federation of Science Clubs, the National Association for Research in Science Teaching, the American Nature Study Society, the Division of Chemical Education of the American Chemical Society, the American Council of Science Teachers, the North Central Association of Science and Mathematics Teachers, the American Science Teachers Association, the Catholic Conference of Science Teachers, the Middle States Association of Science Teachers and the American Association of Physics Teachers. Professor Philip G. Johnson, of Cornell University, is acting chairman of the commission, the purposes of which are as follows:

1. To make the influence of science organizations a potent force through the unification of their efforts.
2. To bring about a national offensive so that the sciences may be given a just and reasonable opportunity to serve the needs of all youth.
3. To study the effects of this war on science teaching

and to make recommendations with respect to the more desirable types of pre-induction training.

4. To plan a long-range program for the improvement of science teaching.
5. To assist science teacher organizations in reaching science teachers and school administrators.
6. To stimulate widespread and intelligent cooperative action on problems of science teachers.

At this informal meeting, it was suggested that the time is ripe for a national organization of science teachers to include the following features:

1. Sponsorship by both educators' and scientists' groups, probably jointly by the National Education Association and the American Association for the Advancement of Science.
2. Scope broad enough to include the interests of all science teachers.
3. Fusion of various groups such as the American Science Teachers Association, the National Commission of Science Teaching and perhaps others, to achieve an economy of interest.
4. Fusion of several journals into one publication but in no case interference with regional groups nor with specialized journals.

Dr. Mary C. McKee, of the department of chemistry of Connecticut College, New London, will be the local representative.

THE NATIONAL COUNCIL FOR STREAM IMPROVEMENT

THE National Council for Stream Improvement (of the pulp, paper and paperboard industries), New York City, has announced the establishment as of May 24, of a multiple industrial fellowship in Mellon Institute at Pittsburgh, that will soon begin operation. The research program of this fellowship, which will be conducted by specialists and for which the institute will provide complete facilities, will pertain to the development of satisfactory methods for the disposal and utilization of wastes from the manufacture of pulp, paper and paperboard. Its aim will be to develop new economic procedures for eliminating stream contamination resulting from the discharge of wastes. Pollutive materials of the industries concerned will be investigated thoroughly with the objective of devising novel and effectual methods for processing these wastes, to secure values from them, and to gain information of usefulness to individual companies in coping with their particular disposal problems. It is also planned to coordinate research work in this field.

The National Council for Stream Improvement is supported by contributions from pulp, paper and paperboard manufacturers, such contributors being assessed on a tonnage basis and representing the greater part of the total pulp, paper and paperboard produced in the United States. In addition to the fellowship at Mellon Institute, other research programs will be established in organizations in various regions of the United States where urgent problems exist, all being under the general supervision of Mellon Institute and the Board of Governors and staff of the National Council.

THE PITTSBURGH MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THE semi-annual meeting of the American Society of Mechanical Engineers was held at Pittsburgh from June 19 to 22. The program was devoted to war production with special emphasis on aviation and other subjects covering applied mechanics, metals engineering, rubber and plastics, management, quality control, instruments, lubrication, fuels and power.

In addition to the technical papers and addresses, E. D. Newbury, vice-president of the Westinghouse Electric and Manufacturing Company of East Pittsburgh, addressed a management luncheon on June 19 on "The Value of Experience in War Production Towards Problems of Reconversion." Colonel William A. Weaver, of the Technical Division of the Office of Chief of Ordnance, Washington, D. C., spoke at a luncheon on June 20 on "Army Ordnance in the South Pacific." The speakers on railroad topics included Colonel J. Monroe Johnson, director of the Office of Defense Transportation, Washington, D. C.

The Calvin W. Rice Lecture was delivered at a luncheon on June 21 by K. Y. Chen, China Defense Supplies, Inc., Washington, D. C. He spoke on "What Postwar China Hopes for from the United States Engineers." J. C. Wright, of the U. S. Office of Education, Washington, D. C., and others discussed postwar training and rehabilitation.

At the reception and dinner on the evening of June 21 Igor I. Sikorsky, engineering manager of the Sikorsky Aircraft, Bridgeport, Conn., spoke on "Direct Lift Aircraft." Robert M. Gates, of New York, president of the society, presided at the general sessions. Visits were made to the plants of a number of Pittsburgh industries.

GRANTS OF THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

GRANTS amounting to $1,128,770 were made by the medical advisory committee at the semi-annual meeting on May 15 and 16 of the National Foundation for Infantile Paralysis, to leading universities, laboratories and other organizations throughout the United States. The appropriations included $536,500 in the field of after effects; $392,400 in the field of virus research and $199,870 in the field of education. All grants will be in effect by July 1.

These grants include three long-term appropriations, each covering a five-year period. Two of these,

amounting to $495,000, provide for the establishment of two "Units for Research in Physiology as Related to Physical Medicine," for the purpose of improving knowledge in the field.

The larger of these two units will be at the Medical School of the University of Minnesota, for which the grant amounts to $320,000. The work to be undertaken there will be an expansion of a project previously inaugurated designed to throw new light on the physiological problems encountered and on the clinical application of methods in the field of physical medicine. The general direction of the proposed investigation will be assigned to a committee consisting of the heads of the departments concerned, with Dr. Maurice B. Visscher, head of the department of physiology, as chairman.

Under a grant for $175,000 the second unit will be established at the Medical School of Northwestern University, which was one of the first institutions to adopt a department of physical medicine and to encourage research in this specialty.

The third long-term grant of $325,000 was made to the School of Public Health of the University of Michigan to finance a virus study unit. This unit represents a direct attack on the cause of the disease since it provides both for virus research and for the training of virologists. The work at the University of Michigan will continue to be under the direction of Dr. Thomas Francis, Jr., professor of epidemiology.

THE NEW YORK ZOOLOGICAL SOCIETY

AFTER an informal luncheon meeting of the New York Zoological Society on June 15, which was attended by forty-three fellows representing various branches of science, it was announced by Fairfield Osborn, president of the society, that after the war it is proposed to erect at a cost of $200,000 a biological and pathological research center in the Bronx at or near the Zoological Park.

It was stated that in no case does the plan entail use of any of the animal collections for experimental purposes in pathological studies. Only animals that become sick or die will be used. It is planned to keep the center open twenty-four hours a day, available to students in medical centers and universities.

The tentative plans call for a two-story building consisting of laboratories for research in chemistry, biology, bacteriology, parasitology, physiology, photography, etc. It is proposed to appoint a scientific advisory council to put the plans into effect.

Fellows present at the meeting who took part in the discussion included Dr. Francisco Duran-Reynals, associate professor of medicine at the medical school of Yale University; Dr. George M. Smith, associate of the department of anatomy, School of Medicine of Yale University; Dr. Robert Cushman Murphy, chairman of the Department of Birds, American Museum of Natural History; Dr. Ernst Mayr, curator of the Whitney-Rothschild Collections, Department of Birds, American Museum of Natural History; Dr. John S. Nicholas, Sterling professor of zoology, Yale University; Dr. A. E. Parr, director of the American Museum of Natural History; Dr. Horace W. Stunkard, professor of physiology, New York University, and Dr. William Beebe, honorary curator and director of the department of tropical research of the society.

SCIENTIFIC NOTES AND NEWS

THE honorary degree of doctor of science was conferred by Tulane University at its commencement on May 31 on Dr. T. Wayland Vaughan, B.S., 1889, associate in paleontology of the U. S. National Museum, in recognition of his contributions to geology and oceanography.

DR. AUSTIN MCDOWELL PATTERSON, professor emeritus of chemistry of Antioch College, now principal specialist in chemical education for the Engineering, Science and Management War Training Program of the U. S. Office of Education, received the honorary degree of doctor of science at the annual commencement exercises of the college.

THE staff of the department of botany, and graduate students in plant physiology, of the University of Chicago gave a dinner on June 5 in honor of Dr. and Mrs. Charles A. Shull. There were twenty-nine persons present. Dr. E. J. Kraus was toastmaster. After the dinner, Dr. Walter F. Loehwing spoke on Dr. Shull's influence on plant physiology through his researches, his leadership in the American Society of Plant Physiologists and as editor of *Plant Physiology*. Dr. Scott V. Eaton presented a bound volume of eighty-eight letters from students, colleagues in the department of botany and a few friends to which Dr. Shull responded. Mrs. Shull, who recently published her second volume of poems, read a poem composed especially for the occasion. Dr. Shull will retire at the end of September. He and Mrs. Shull will move to Asheville, N. C.

CLIFFORD H. POPE, curator of amphibians and reptiles at the Chicago Natural History Museum, and Dr. Ernst Mayr, curator of the Whitney-Rothschild Collections of the American Museum of Natural History, have been elected fellows of the New York Zoological Society.

PROFESSOR SOLOMON LEFSCHETZ, of Princeton University, who is lecturing at the Institute of Mathematics of the University of Mexico, was the guest of honor on the occasion of the Guanajuato City meeting of the Mathematical Society of Mexico.

PRESENTATION was made at the St. Louis meeting of the American Institute of Electrical Engineers of the Faraday Medal, which was awarded in February to Dr. Irving Langmuir, associate director of the General Electric Research Laboratory. The presentation was made by Dr. A. P. M. Fleming, director and manager of research and education of Metropolitan-Vickers Electrical Company, Ltd., Manchester, England.

AT a recent meeting of the American Society of Mechanical Engineers Orville Wright and Dr. Harvey N. Davis, president of Stevens Institute of Technology, received certificates of honorary membership in the British Institution of Mechanical Engineers. Lord Halifax, the British Ambassador, made the presentation to Dr. Davis, and Dr. Robert Gates, president of the American Society of Mechanical Engineers, accepted for Mr. Wright in his absence. Dr. Gates presented to Lord Halifax a certificate of honorary membership in the American society to be transmitted to Dr. Harry R. Ricardo, in recognition of "his work in the field of internal combustion and as president of the British Institution." A copy of the Breda portrait of James Watt, inventor of the steam engine, was presented as a gift from the British Institution.

PROFESSOR W. N. HAWORTH, professor of chemistry at the University of Birmingham, has been elected president of the Chemical Society, London.

ON the joint recommendation of the presidents of the Royal Society and the British Institution of Civil Engineers, the council of the institution has awarded the James Alfred Ewing Medal for 1943 to Group Captain Frank Whittle. The Ewing Medal is awarded annually for specially meritorious contributions to the science of engineering in the field of research.

THE Colwyn Gold Medal has been awarded by the British Institution of the Rubber Industry to A. Healey, a director of the Dunlop Rubber Company, for conspicuous services in connection with the technique of tire manufacture, with special reference to the use of synthetic rubbers.

PROFESSOR ALEXANDER FLEMING, F.R.S., has been appointed Harben lecturer for 1944 by the Royal Institute of Public Health and Hygiene. His lectures, which will be given at the end of the year, will deal with penicillin—its discovery, development and uses in medicine and surgery.

DR. C. H. BEST, F.R.S., professor of physiology at the University of Toronto, has been elected a member of the Athenaeum, London.

THE American Society of Plant Physiologists has elected the following officers for terms beginning on July 1: Dr. H. A. Spoehr, *President;* Dr. F. W. Went, *Vice-president;* Dr. Charles A. Shull, *Member of the Executive Committee;* Professor D. R. Hoagland, *Member of the Editorial Board.* The term of the present secretary, Dr. Earl S. Johnston, continues for another year.

AT the recent annual banquet of the Florida Chapter of the Society of the Sigma Xi the following officers were installed: Professor T. H. Hubbell, *President;* Professor A. A. Bless, *President-elect;* Professor H. H. Hobbs, Jr., *Secretary;* Professor R. H. Westveld, *Treasurer,* and Professor F. B. Smith, *Marshal.*

DR. ROLLO C. BAKER, chairman on leave of the department of anatomy of the University of Illinois, will retire at the close of the academic year. He will retain his position as acting dean of the College of Medicine. The retirement is also announced of Dr. J. Ernest Carman, since 1929 head of the department of geology.

DR. CAREY CRONEIS, professor of geology at the University of Chicago, has been chosen the fifth president of Beloit College. He will take office on September 1.

AT Yale University in the department of astronomy Dr. Dirk Brouwer has been designated Munson professor of natural philosophy and astronomy. Dr. Lyman Spitzer, Jr., has been appointed research associate in astrophysics with the rank of associate professor, but he will continue during the coming academic year to work with the Division of War Research at Columbia University. Dr. Victor Goedicke has been promoted to the rank of assistant professor.

DR. T. W. DANIEL, of the Western Washington Agricultural Experiment Station at Puyallup, Wash., formerly a member of the California Forestry and Range Experiment Station and the School of Forestry of the University of California, has been appointed professor of silviculture at the Utah State Agricultural College at Logan. He will be in charge of instruction in silviculture and will manage the forest nursery maintained jointly by the school and the U. S. Forest Service.

AT the University of London, Dr. T. A. Bennet-Clark, professor of botany at University College, Nottingham, has been appointed to the chair of botany, and Dr. C. T. Ingold, head of the department of botany at University College, Leicester, has been appointed to the chair of botany in Birkbeck College.

DR. WILLIAM S. MARSHALL, professor emeritus of entomology of the University of Wisconsin, has been appointed research associate in entomology at the Milwaukee Public Museum, and Dr. Lloyd H. Shinners, of the Milwaukee County Park System, has been appointed research associate in botany.

DR. GEORGE B. CRESSEY, chairman of the department of geology and geography of Syracuse University, representative in China of the U. S. Department of State, who has been in China since September as a visiting professor, will return to the United States in the near future.

DR. DONALD C. MACLACHLAN, associate professor of geology at Wayne University, will continue this summer his survey of ancient lake beaches in the Saginaw Valley to determine the nature and location of areas believed to contain important oil and gas pools. The survey was initiated a year ago as part of a project conducted by the Geological Survey Division of the Michigan Department of Conservation to discover undeveloped mineral deposits throughout the state.

THE annual science lecture of the Santa Barbara State College Club of the Society of Sigma Xi was delivered on the evening of June 3 by Dr. Francis Marsh Baldwin, chairman of the division of biology of the University of Southern California, president of the Southern California Chapter of the society. The title of the lecture was "How Burn the Fires of Life."

THE thirty-ninth annual meeting of the American Dairy Science Association was held on June 20, 21 and 22 at the Ohio State University under the presidency of Dr. A. C. Dahlberg, of the department of dairy industry of Cornell University. He is succeeded by the vice-president of the association, Dr. A. C. Ragsdale, of the University of Missouri.

THE department of pathology and bacteriology in the School of Medicine of the Louisiana State University received the gold medal, the highest award for exhibits at the meeting of the American Society of Clinical Pathologists in Chicago. The title of the exhibit was "The Pathology of Amebiasis, Malaria and Histoplasmosis."

A SCHOOL of Veterinary Medicine at Davis will be established by the University of California as soon as construction can be undertaken. On recommendation of Dean C. B. Hutchison, of the College of Agriculture, an appropriation of $500,000 has been made by the Legislature for the new school, and an additional $500,000 is expected from the post-war building funds provided by the Legislature. The department will be set up in the College of Agriculture, coordinate with the departments of agriculture, forestry and home economics. The faculty of the school will be drawn not only from the department of veterinary science, but from other departments, including the department of agriculture and the Medical School.

THE National Geographic Society has issued a ten-color wall map of Germany and its approaches. Taking in the Channel Coast of England and the coast of continental Europe from Le Havre to Copenhagen, the map reaches south to the industrial cities of northern Italy and includes nearly all Hungary and Yugoslavia as far as Belgrade.

The Times, London, states that the British Colonial Office has made arrangements for scientific research and survey work to be resumed in some of the most remote British possessions, the Dependencies of the Falkland Islands, the most important of which are the South Shetlands, South Orkneys, South Georgia and Grahamland. The research party and administrative officials have arrived, and bases have been established. The bases are fully equipped and self-contained, and the party is expected to remain in the Antarctic for a long time. The expedition is under the direction of Lieutenant-Commander J. W. S. Marr, R.N.V.R.

DISCUSSION

LIQUEFIED-GAS METHOD OF PRODUCING GERMICIDAL AEROSOLS

THE liquefied-gas method of producing insecticidal aerosols, as described by Goodhue and Sullivan,[1] Goodhue,[2] and Sullivan, Goodhue and Fales,[3] has proved very useful in the control of disease-carrying mosquitoes. It is especially well adapted to military needs in remote tropical areas, where transportation, simplicity of equipment and ease of operation are important. The product consists of a solution of pyrethrum extract and sesame oil in dichlorodifluoromethane, which is held in a pound-size handy container ready for use at any moment. The dichlorodifluoromethane acts as the solvent, furnishes the pressure for spraying and provides the energy to disperse the

[1] L. D. Goodhue and W. N. Sullivan, U. S. Patent 2,321,023, issued June 8, 1943.

[2] L. D. Goodhue, *Indust. and Engin. Chem.*, 34: 1456–9, 1942.

[3] W. N. Sullivan, L. D. Goodhue and J. H. Fales, *Jour. Econ. Ent.*, 35: 48–51, 1942.

insecticide as a colloidal suspension in air. The nontoxic and nonflammable nature of the gas is responsible for the success of this method.

Germicidal aerosols have been given considerable attention in recent years, and colloidally dispersed propylene glycol, hexylresorcinol and other compounds[4,5,6] have been found effective when applied in this form. The aerosols were produced by heat,[7] by some mechanical means such as the "Phantomyst"[8] machine developed in England or by some special atomizer.

An adaptation of the liquefied-gas method to the production of germicidal aerosols is logical. A few preliminary tests have been made to show the applicability of this method. The following solutions were tested: (1) Propylene glycol 5, ethanol 20, and dichlorodifluoromethane 75 per cent.; and (2) hexylresorcinol 0.15, olive oil 9.85, and dichlorodifluoromethane 90 per cent.

Since propylene glycol is not very soluble in dichlorodifluoromethane, a mutual solvent, such as ethanol, was necessary. In the second solution a commercial preparation consisting of 2.5 per cent. of hexylresorcinol in olive oil was used as the germicide.

A 216 cubic foot chamber was sprayed with a water suspension of nonpathogenic bacteria. After 10 minutes agar plates were exposed for 1 minute. Ten grams of the germicidal aerosol was then sprayed into the chamber and other agar plates were exposed. About 95 per cent. reduction in the bacterial growth on the plates was obtained with solution 1 and a considerable reduction with solution 2.

From these preliminary tests it would appear that this method of producing germicidal aerosols might be practical. These results are presented merely to call attention to the possibility of using a nontoxic, nonflammable liquefied gas as a self-propelling vehicle for dispersing germicidal aerosols. Since the study of germicides is outside the field of research of the Bureau of Entomology and Plant Quarantine, the writers plan no further tests of this method and hope that others will be interested in exploring its possibilities.

LYLE D. GOODHUE
E. R. MCGOVRAN

U. S. DEPARTMENT OF AGRICULTURE

[4] O. H. Robertson, E. Bigg, B. F. Miller, Z. Baker and T. T. Puck, SCIENCE, 93: 213–4, 1941.
[5] O. H. Robertson, E. Biggs, T. T. Puck, B. F. Miller and E. A. Appell, *Jour. Expt. Med.*, 75: 593, 1942.
[6] T. N. Harris and J. Stokes, *Am. Jour. Med. Sci.*, 204: 430–6, 1942.
[7] The Personnel of Naval Laboratory Research Unit No. 1, SCIENCE, 97: 208, 1943.
[8] J. V. Pulvertaft and J. W. Walker, *Jour. Hyg.* [London], 39: 696–704, 1939.

THE PREPARATION OF ISOLATED CELL NUCLEI OF RAT LIVER[1]

IN a recent volume on cytochemistry,[2] Hoerr in a chapter on liver cells (page 185) has referred several times to my work on the isolation of cell nuclei of rat liver.[3] Two of his comments in particular convey erroneous impressions.

One of the points is that Hoerr doubts the final pH of the original mixture of M/475 citric acid and liver (pages 226–227), and states that the dissociation constants of citric acid make it difficult to understand how the liver can buffer the suspension to a pH as high as 6.0–6.2. Apart from considering that the dissociation constants of the citric acid constitute only one factor in determining the final pH, the other factor being the ratio of the amount of citric acid to the amount of liver employed, it is useless to theorize about this point, since our final pH values were checked carefully on repeated preparations with the glass electrode. Of course the livers must not be allowed to stand at room temperature after removal from the animals, or glycolysis will cause a rapid accumulation of lactic acid.

Another point by Hoerr requiring comment is his statement on page 213 that "It is possible that the nuclei obtained by Dounce's method have gelled to a certain extent because of the beating they receive in the Waring blendor; nucleoproteins are probably thixotropic, and the ease with which nuclear substances may undergo gelation is evident, if the work of Chambers over many years is considered."

Usually one considers a thixotropic material as one which is in the state of a gel when quiescent but whose gel state breaks up on agitation. Aside from this, the amount of "beating" the nuclei receive while in the blendor is to a considerable extent dependent upon the total amount of suspension in the blendor. When the nuclei are first liberated by stirring 100 gm of liver with 500 cc of M/475 citric acid, a relatively small percentage is damaged, while on the other hand isolated nuclei can be torn completely to fine fragments if they are suspended in 100 cc of water or less and stirred in the blendor for sufficient time.[4] Moreover, nuclei have been prepared which one might with considerable justification call gelled nuclei,[4] and these show quite different properties from the nuclei prepared at pH 6.0–6.2.

Hoerr also makes the following statement on page

[1] From the Department of Biochemistry and Pharmacology, the University of Rochester School of Medicine and Dentistry, Rochester, N. Y.
[2] "Biological Symposia," Volume X. Edited by Jaques Cattell. The Jaques Cattell Press, Lancaster, Pa.
[3] A. L. Dounce, *Jour. Biol. Chem.*, 147: 685, 1943.
[4] A. L. Dounce, *Jour. Biol. Chem.*, 151: 221, 1943.

226: "The formation of intracellular or intranuclear gels, in other words, would not interfere in the least with enzyme activity." This statement probably is not true.[4, 5]

It should be pointed out that nuclei prepared by my method at pH 6.0–6.2 are not in the same state as they were in the living cell. It is doubtful whether any isolated nuclei could be in exactly the same state unless they were suspended in undamaged cytoplasm itself. The lowering of the pH from cell pH to 6.0–6.2 causes a shrinking of the nuclei and very possibly some coagulation and dehydration of nucleo-protein, which results in a microscopic appearance similar, as Hoerr states on page 226, to that of fixed tissue. Moreover, it should be remembered that the object of the preparation of nuclei at pH 6.0–6.2 was to obtain nuclei which would be satisfactory for enzyme studies, and this was accomplished.

ALEXANDER L. DOUNCE

DIURNAL BEHAVIOR CYCLE IN SPIDERS

IN connection with Dr. Haseman's and Dr. Craig's notes on twilight behavior patterns in horseflies and birds,[1] the following field observations are offered concerning allied characteristics in orb-weaving spiders.

In general, evening brings transition to a phase of greater activity, dawn to a lesser. This may be related to the lesser nocturnal activity of their principal enemies, the wasps and birds. Among locally common species the variation of day-night behavior is especially marked in *E. strix,* relatively slight in *A. aurantia* and *A. trifasciata.* The writer's observations on this point have been mostly with *C. conica* and *E. cavatica.*

If a vibrating tuning fork is opposed to the dorsum of *C. conica,* resting as normally at orb-center, during the daytime, the creature drops a distance not commonly less than three nor more than eighteen inches, and after a few seconds returns. If the fork is presented at night, the fork is instead attacked. The transition from the escape to the attack pattern, which is gradual, and its reverse, may be observed with relative precision by making rounds among a series of nests about sunset and sunrise.

E. cavatica may be similarly observed and more conveniently, as it is the most nearly "social" of locally common species. Dozens of them, in all stages of maturity, with webs intimately interconnected, have been observed on this point in old outbuildings, mostly in central New Hampshire. Till the individual is about one-fifth adult size, it behaves in this respect substantially like *C. conica.* The adult does not exhibit the dropping response, rather a form of "spreading," as elsewhere described,[2] and is generally more aggressive. The dropping response seems to be a function of the size of an individual rather than its species. Small individuals show it in the daytime irrespective of maturity; large ones do not. To the tuning-fork, the dropping response is notably absent in the young *Argiopes.* This dropping response is not an avoidance of the fork as such; small *E. cavaticas* have repeatedly been observed to drop through the tines, held slightly below the resting place in the orb. Also I have observed *C. conica* to drop to the human voice. A farmer once told me of a barnful of young *cavaticas* responding similarly to the blast of a toy horn.

In observations with *E. strix* and *E. insularis* it has been possible in some sort to restore the daytime pattern of behavior by crude artificial illumination (electric or acetylene handlamps). *Strix* goes back, after minutes, to its daytime retreat. In *insularis,* the main change recalled is the replacement of "seizing" the fork, by the less aggressive "spreading" pattern, though retreat may be expected to ensue with protracted illumination.

In *E. insularis* and *E. trifolium,* around sunrise and sunset, response threshold changes have been observed. These species, practically identical in their behavior, spend the daytime in a retreat not usually more than eighteen inches from orb-center, and directly connected to it by a stout thread. If during the daytime the orb is touched with a vibrating tuning-fork, they do not ordinarily emerge. At dusk they emerge of themselves, and they emerge to the tuning-fork more and more readily as dusk approaches. Shortly after they have as normally retreated about sunrise, they can be brought out again by the tuning-fork, but less and less readily as daylight increases. Such observations can easily be made to a desired degree of control with species that frequent buildings, such as *cavatica* or *strix.*

F. L. WELLS

HARVARD UNIVERSITY

MORE ABOUT WHITE BLACKBERRIES

A YEAR or so ago I sent you a note about some wild white-fruited blackberries I discovered near Gainesville, Fla., and named the variety *albifructus.* I planted the seed of these berries and in two years had 104 fine bushes in bearing. When the fruit ripened every single berry on all the bushes was black. Near the wild plants from which the white berries were taken there was a patch of normal black-fruited plants. The pollen of these plants was carried to flowers of the white-fruited plants by insects and, black being dominant, the seed produced black-fruited

[5] A. L. Dounce and D. Seibel, *Proc. Soc. Exp. Biol. Med.,* 54: 22, 1943.

[1] SCIENCE, 97: 285, 1943; *ibid.,* 99: 125, 1944.

[2] *Psyche,* 43: 11, 1936.

plants. This showed me at once that in order to propagate my white-fruited berries I could not rely upon seed. Experiments are still in progress and the results will be reported later.

WILLIAM A. MURRILL
UNIVERSITY OF FLORIDA

INSTIGATOR OF THE WEATHER BUREAU

I WISH to add some evidence to the article by Edward P. Alexander in SCIENCE for March 31, 1944, showing that Increase A. Lapham was the father of our present system of forecasting the weather. The question of originality is of long standing. It is mentioned in a memorial to Lapham written by Dr. P. R. Hoy in 1876.[1] On page 234 of this volume is to be found the following letter:

SMITHSONIAN INSTITUTE,
WASHINGTON, Feb. 3, 1876.

DR. P. R. HOY, Racine, Wis.:

Dear Sir: Your letter was received during a great pressure of business, and I now embrace the first opportunity to give it a reply.

The action of Congress in regard to the signal service was due to the immediate exertions of Mr. Lapham through the member of Congress from his district, General Payne, in setting forth the advantages of the system to the commercial interests of the great lakes.

Yours very truly,

JOSEPH HENRY.
Secretary.

A. W. SCHORGER
MADISON, WIS.

SCIENTIFIC BOOKS

CIVILIZATION AND DISEASE

Civilization and Disease. By HENRY E. SIGERIST. xi + 255 pp. Cornell University Press. 1944. $3.75.

THIS volume of approximately two hundred and fifty pages is based on the Messenger Lectures delivered by Sigerist in 1941 at Cornell University. In scope, these lectures represent the attempt to correlate medicine with the processes of the humanization of man in society. The method by which Sigerist seeks to attain his end lies in the linkages between civilization as a whole and disease and the more detailed relationships between disease, economics, sociology, law, history, religion, philosophy, science, literature and art. This constitutes a fairly large order which must needs have failed had its fulfilment been undertaken by any other than such an intellectual amphibian as Dr. Sigerist.

The first chapter which lays down the thesis that the broad, general processes of civilization necessarily involve the incidence of disease, because social progress along the path of man's ascent is bound up with proper food supply, avoidance of physical hazard, protection against the elements and the general safeguarding of body functions. This in turn means, by and large, the preservation of function or the sacrifice of it to disease. Sigerist, in common with all the other well-known historians, starts his story with primitive man. Indeed he starts back farther than that, with the transition from paleolithic to neolithic man. I have been waiting for years for some medical historian to go even farther back than that and show what primitive man himself learned from animals, by way of mutual aid and self-cure. It can be done. Prince Peter Alexander Kropotkin has well defended the thesis that mutual aid has been a greater factor in evolution than has conflict in the struggle to survive. Sigerist himself hints at this fact in his chapter on "Disease and Law," in which he comments on the social life among animals.

Throughout the entire volume there is clearly manifest the author's profound interest in the sociological problems of health. This slant, however, is most clearly manifest in the first chapter in which malnutrition, maldistribution of goods and wealth and the consequent evils are pictured. The effect of clothing and climate, personal hygiene, housing, lighting and heating of homes, sewage disposal and water supply is discussed in their historic relation to disease. Even gluttony is not overlooked.

These considerations lead logically to the chapter on "Disease and Economics," in which is laid down with broad and sure strokes the author's picture of the influence of economics on disease. Starting with the basic concept that work is a powerful factor in health, he travels along the road of occupational health hazards, documenting his views with citations from the literature dating as far back as Ulrich Ellenbog's 1473 treatise on toxic fumes and coming as far into recent times as Falk's 1936 work on "Security Against Sickness." He relies on McCready to support the thesis that no small part of the ill health of Americans is due to the struggle after wealth, and he quotes the founder of experimental hygiene, von Pettenkofer, in support of the truth that the economic loss due to disease is enormous.

No bridge is necessary to cross the gap from economics to social life in relation to disease. Sigerist slides smoothly into this topic with the opening sen-

[1] *Trans. Wis. Academy of Sciences, Arts, and Letters,* Vol. 3, 1876, p. 265.

tence, "No one lives alone." So condensed is the substance of this section that a scant page separates the Sumatran Kubu tribes from the Christian ideal of charity, healing and restoration. Venereal disease, tuberculosis, leprosy and mental disease are the *leit motifs* in the exposition of the interrelationships of disease and social life.

From here on the story runs smoothly through the interrelationships between disease and the law; disease and history (the role of the bubonic pest typhus, cholera, dysentery, malaria and scrofula as world plagues); disease and religion (with a sanely balanced and appreciative concept of faith healing as demonstrated by the rationalized Emmanuel movement, the decidedly nebulous cult of Christian Science and the frank humbug based on auto-suggestion techniques); disease and philosophy; disease and science (stressing such factors as the ferment in thought flowing from the labors of Vesalius, Harvey, Morgagni, Bichat and Pasteur); disease and literature; disease and art (largely a restatement of the objectives of Charcot and Richter in the "Nouvelle Iconographie" and other publications, and Hollaender's "Atlas of Medicine in Classical Art").

The final chapter on "Civilization Against Disease" furnishes Sigerist a platform for a short restatement of his well-known humanistic interest in social needs and the methods of their accomplishment.

All in all, the volume is a fine example of "infinite riches in a little room," substance that one may read as he runs. Its brevity lends charm through the skill with which the condensation is wrought. To the cognoscenti, there is evidence on every page of mastery, no small part of which displays itself in the selection of admirably suitable illustrations. An accurate index contributes value to the whole. Only one minor note jars a bit, Sigerist's loose use of "tubercular" for "tuberculous."

No review of this book on "Civilization and Disease" would be complete without reference to the peculiarly appropriate time of its appearance. To those of us who are sufficiently optimistic in temperament to visualize peace just around the corner and sufficiently hedonistic in our thinking to hope for a happier post-bellum world, there is solid substance in the lessons of the historic past, as Sigerist has set them down. Whether or not we shall be wise enough to see to it that these lessons are taken to heart in peace planning —well, in the language of the immortal Kipling, that is another story.

M. G. SEELIG
THE BARNARD FREE SKIN AND CANCER HOSPITAL,
ST. LOUIS, MO.

BAROMETRIC PRESSURE

Barometric Pressure. By PAUL BERT. Translated by M. A. and F. A. HITCHCOCK. xxxii + 1055 pp. 89 figs. Columbus, Ohio: College Book Company. 1943.

THE completion of the formidable task of translating this celebrated monograph must afford its authors a great satisfaction, and must inevitably call forth well-deserved praise from its readers. Seldom are we privileged to study as careful and accurate a translation of a monumental treatise such as this chef d'oeuvre of Paul Bert. Constant attention undoubtedly has been paid to a presentation as close to the original as possible, and although at times a smoother translation could be desired, one feels that its sacrifice in favor of accuracy in most instances was wise. The improvements mentioned by the authors in their translators' preface are helpful indeed. They have arranged the format in a way to which most of us are much more accustomed than the French method, by placing the table of contents at the front of the book, and by including an admirable index at the end. The brief foreword, written by Professor John F. Fulton, sets the stage and forms an admirable curtain-raiser for the text that follows.

Although it might seem proper to restrict the present remarks to Professor and Mrs. Hitchcock's most timely and long needed translation, the reviewer feels that in this case it is necessary to say something about the work itself; a work which won for its author a high place, not only among his colleagues of the Academy of Sciences, but also among scientists of past and future generations. Remarks related to existence at high altitudes can be found in the literature as far back as Aristotle, and observations on air pressure have accumulated since the days of Galileo and Torricelli, but it remained for Paul Bert to point out the role of diminished partial pressure of oxygen in producing the physiological effects reported as a result of exposure to high altitude experiences. How astounding the revelation must have been to those aware of his discoveries, that oxygen, the basic necessity of life, so easily could become a prime factor in the destruction of cells and tissues, and in their ultimate death!

Bert's long series of investigations originally appeared in the *Comptes Rendus de l'Académie des Sciences* (1871–1875). The book, now translated for the first time, was published in 1878 and, as pointed out by Dr. Fulton, stands to-day as the cornerstone of modern altitude physiology. It is divided into three parts: historical, experimental and summary and conclusions. The historical section is an astonishing sum-

mation and discussion of all previous theories and experiments, and of the reports and events of balloon ascensions and mountain journeys in all parts of the world. It represents a prodigious amount of perseverant bibliographic collation and analysis, and stands out as a fine example not only of the lengths to which a scholarly investigator will go to familiarize himself with the contributions of his predecessors, but also of an exceptional example of medical historical writing.

The second part contains the experimental protocols. Over 660 experiments were performed, in which plants, animals, ferments, poisons, viruses and even Bert himself were subjected to changes in barometric pressure. The experiments are beautiful in their simplicity and directness, and with the final résumé section, are remarkable examples of precise, logical scientific investigation and reporting. They include solutions of myriad problems as well as numerous signposts pointing the way towards future studies.

This work, one of the most important in the physiological archives, deserves to be read by many who have neglected it in the past, especially in these unfortunate days during which the ideas with which it is concerned have become of such vital importance in aviation medicine.

ROBERT GRENELL

SOCIETIES AND ACADEMIES

THE KANSAS ACADEMY OF SCIENCE

THE seventy-sixth annual meeting of the Kansas Academy of Science was held at Topeka, Kansas, on April 15, with Dr. Harvey A. Zinszer, Fort Hays Kansas State College, Hays, Kansas, presiding. The affiliated society, the Kansas Entomological Society, met with the academy. Other state societies which met with the academy were the Kansas Association of Teachers of Mathematics and the Kansas chapter of the Mathematical Association of America.

The meetings were at Washburn Municipal University of Topeka, where the society was organized on September 1, 1868. The societies were welcomed by President Bryan S. Stoffer, of Washburn University.

The meeting was shortened to the one day, as was the diamond jubilee meeting last year. The interest shown justified the decision of the academy council to hold short stimulating meetings annually during the war emergency. Cancellation of national and sectional meetings makes that of the state organization more important as a common meeting ground for scientists of the state.

During the day section meetings were held for Botany (interpreted broadly to include Bacteriology and Agronomy), Chemistry, Geology, Physics, Psychology and Zoology. No attempt was made to hold a section of the Junior Academy because of the transportational difficulties, but local chapters had been encouraged to hold meetings at which the outstanding demonstrations, papers and exhibits were selected. In certain instances local civic clubs provided prize money for the winners. The academy council voted that high-school science clubs which are members of Science Clubs of America may become members of our Junior Academy of Science without payment of our membership fees.

The annual banquet was held in the evening with the newly installed president, Dr. Leland D. Bushnell, presiding as toastmaster. I. D. Graham, of Topeka, who became a member of the academy in 1879, was present. Dr. Harvey A. Zinszer as retiring president gave the address, entitled "Famous Early American Observatories." The banquet was followed by the annual public meeting. The program for this meeting consisted of an invitational address by Dr. Joel Stebbins, director of the observatory, University of Wisconsin, and research associate, Mount Wilson Observatory. His subject was "The Heavenly Spaces." This technical subject was presented in an interesting manner.

TABLE 1

Name of section	Chairman for 1944	Number of papers on program	Number attending	Chairman for 1945
Botany	Stuart M. Pady	12	40	Elva L. Norris
Chemistry	Worth A. Fletcher	9	30	Harry H. Sisler
Geology	W. H. Schoewe	8	10	J. R. Chelikowsky
Kansas Entomological Society	Elmer T. Jones	10	20	W. T. Emery
Kansas Chapter of Mathematical Societies of America	Paul G. Eberhart	7	60	Edison Greer
Kansas Association of Teachers of Mathematics	Herbert H. Bishop	7	60	Sara Belle Wasser
Physics	Ernest K. Chapin	7	18	P. S. Albright
Psychology	Maurice C. Moggie	11	21	Homer B. Reed

The total attendance was 210. The reports of the section chairmen are presented herewith in Table 1. The next annual meeting of the academy will be held at Kansas State College, Manhattan, Kansas.

The following officers were elected for the next year and meeting: *President,* Dr. Leland D. Bushnell,

Kansas State College; *President-elect,* Dr. John W. Breukelman, Kansas State Teachers College, Emporia; *Vice-president,* Dr. Claude W. Hibbard, University of Kansas; *Secretary,* Dr. Donald J. Ameel, Kansas State College; *Treasurer,* Dr. F. W. Albertson, Fort Hays Kansas State College; additional executive council members, Dr. Harvey A. Zinszer. Fort Hays Kansas State College; Miss Edith P. Beach, Lawrence High School; Dr. Paul G. Murphy, Kansas State Teachers College, Pittsburg; and Dr. Philip S. Riggs, Washburn Municipal University. Dr. Robert Taft, of the University of Kansas, was reelected editor of the *Transactions* for a period of three years. Dr. Stuart M. Pady, of Ottawa University, was elected associate editor for a term of three years. Dr. John C. Frazier, of Kansas State College, was elected for a three-year term as representative to the American Association for the Advancement of Science. Dr. M. J. Harbaugh, Kansas State College, was elected academy librarian.

JOHN C. FRAZIER
KANSAS STATE COLLEGE

SPECIAL ARTICLES

INTERFERENCE BETWEEN ST. LOUIS ENCEPHALITIS VIRUS AND EQUINE ENCEPHALOMYELITIS VIRUS (WESTERN TYPE) IN THE CHICK EMBRYO

CERTAIN viruses, when injected into experimental animals, have been shown to influence the course of disease produced by a virus subsequently injected.[1] It has recently been found that this so-called "interference phenomenon" may occur even when the viruses are injected simultaneously.[2] This interference has usually been observed only when closely related viruses were being studied. Data obtained from the experiments reported here indicate that the "interference phenomenon" is not limited to those viruses which are closely related, but that interference may occur between such unrelated viruses as St. Louis encephalitis and equine encephalomyelitis.

EXPERIMENTAL

Ten-day old chick embryos were inoculated with 0.2 cc of a 10 per cent. suspension of either: (1) mouse brain infected with St. Louis encephalitis virus; (2) mouse brain infected with St. Louis encephalitis virus which had been heated at 56° C for 30 minutes, or (3) normal mouse brain. Normal rabbit serum which had been inactivated at 56° C for 30 minutes was used in preparing the above suspensions. The embryos were incubated at 36 to 37° C for 48 hours and then inoculated with 0.2 cc of a 1 to 1,000 suspension of chick embryo infected with equine encephalomyelitis virus (Western type). All injections were made with a ¾-inch 23-gauge needle through the air-space

TABLE 1

TITER OF VIRUS IN ALLANTOIC FLUIDS AND EMBRYO SUSPENSIONS

First inoculum	Second inoculum	Material titrated	Dilutions tested 10^{-1}	10^{-3}	10^{-5}	10^{-7}	10^{-9}	LD 50 titer log of dilution
N. M. B. 5/24/43	W. E. E. 5/26/43	Allantoic fluid	4/4	N. T.	4/4	2/4	0/4*	7.0
		Embryo Suspensions	3/3	3/3	3/3	3/3	0/3	8.0
S. L. E. 5/24/43	W. E. E. 5/26/43	Allantoic fluid	4/4	N. T.	0/4	0/4	0/4	$>1.0<5.0$
		Embryo Suspensions	3/3	3/3	0/3	0/3	0/3	4.0
N. M. B. 6/5/43	W. E. E. 6/7/43	Allantoic fluid	3/3	3/3	1/3	2/3	0/3	6.0
		Embryo Suspensions	3/3	3/3	3/3	3/3	0/3	8.0
S. L. E. (Heated) 6/5/43	W. E. E. 6/7/43	Allantoic fluid	3/3	3/3	3/3	0/3	1/3	6.4
		Embryo Suspensions	3/3	3/3	3/3	3/3	1/3	8.4
S. L. E. 6/5/43	W. E. E. 6/7/43	Allantoic fluid	3/3	1/3	0/3	0/3	0/3	2.4
		Embryo Suspensions	3/3	3/3	0/3	0/3	0/3	4.0

* Numerator = number of deaths; denominator = number of mice tested.
N. M. B. = normal mouse brain.
S. L. E. = St. Louis encephalitis virus (Strain No. 3).
W. E. E. = Equine encephalomyelitis virus (Western type).
N. T. = Not tested.

[1] M. Hoskins, *Amer. Jour. Trop. Med.*, 15: 675, 1935; G. M. Findlay and F. O. MacCallum, *Brit. Jour. Exp. Path.*, 44: 405, 1937.

[2] W. Henle and G. Henle, SCIENCE, 98: 87, 1943.

end of the egg. After receiving the second injection the embryos were incubated an additional 20 to 22 hours.

The allantoic fluid and embryos from eggs which had received identical inocula were harvested and pooled. The embryos were homogenized in a high-speed mechanical blender with sufficient buffered salt solution (pH 7.4) to make a 10 per cent. suspension. After centrifugation at 2,000 R. P. M. for 10 minutes the allantoic fluid and embryo suspensions were titrated intracerebrally in 3- to 4-week-old Swiss mice. The intracerebral titer of the virus recovered was determined by the method of Reed and Muench on the basis of 100-fold dilutions.

RESULTS

It was found (Table 1) that equine encephalomyelitis virus could be readily propagated in embryos which had been previously inoculated either with normal mouse brain or with heated St. Louis encephalitis virus. The amount of virus present in the allantoic fluid and in suspensions of the whole embryos was approximately that which is recovered when equine encephalomyelitis virus is grown in normal embryonated eggs. On the other hand, equine encephalomyelitis virus grew only to a limited degree, if at all, when injected into embryos in which St. Louis encephalitis virus was being propagated. A comparison of the titers of the virus recovered from the three groups indicated that the eggs which contained normal mouse brain and heated St. Louis encephalitis virus when injected with equine encephalomyelitis virus yielded about 10,000 times as much virus as those which had previously been infected with the encephalitis virus and later with the encephalomyelitis virus.

Because it has been observed[3] that in the developing chick embryo St. Louis encephalitis virus reaches a concentration equal to that found in the above eggs infected with the two viruses it is suggested that the growth of equine encephalomyelitis virus could have been completely inhibited, since all the virus recovered could have been that of St. Louis encephalitis.

Although the St. Louis encephalitis virus which was heated at 56° C for 30 minutes was not completely inactivated (2 of 6 mice injected intracerebrally with this material developed a fatal encephalitis) it did not inhibit the growth of equine encephalomyelitis virus. The probable explanation for this finding is that the amount of virus present in the heated material was insufficient to initiate infection in the chick embryo and therefore did not interfere with the growth of the equine encephalomyelitis virus which was subsequently injected.

Further studies along this line have revealed that, in the developing chick, influenza virus (PR8 strain) is able to interfere with or even completely inhibit the growth of equine encephalomyelitis virus. The degree of inhibition is dependent upon the time transpiring between the injection of the influenza virus and the subsequently inoculated equine encephalomyelitis virus. A more detailed report of these findings will appear elsewhere.

[3] C. E. Duffy (unpublished data).

SUMMARY

Interference between two unrelated viruses is reported. Equine encephalomyelitis virus grows only to a limited degree, if at all, when injected into chick embryos in which St. Louis encephalitis virus is being propagated.

CARL E. DUFFY
WAYNE UNIVERSITY

THE OXIDATION AND REDUCTION OF MUSCLE ADENOSINETRIPHOSPHATASE[1]

ALTHOUGH it has been reported that cysteine does not influence the activity of the adenosinetriphosphatase (ATP-ase) of muscle,[2] Barron and Singer[3] have reported that -SH groups may be important for the activity of this enzyme. Our interest in the problem arose from the observation that the ATP-ase activity of rat muscle myosin may show a greater decrease during storage when activity measurements are made at a pH in the neighborhood of 9 than when the measurements are made at pH 6 to 7. Since this effect could not be produced by heat inactivation, it seemed possible that it might be related to the oxidation of the free -SH groups which exist in native myosin.[4] An aged myosin preparation which had shown a greater loss of activity in the alkaline range than in the acid range was treated with 0.02 M cysteine for 20 minutes at 20° C. When the activity was again measured,[5] it was found that the activity at pH 6.8 had decreased 6 per cent., while the activity at pH 9.2 had increased 20 per cent.

In order to show that the ATP-ase activity of myosin is altered by oxidation and that the effects are dependent upon the pH of the activity measurements, myosin was treated with H_2O_2 at pH 7 and then an attempt was made to reverse the effect of peroxide

[1] Aided by a grant from the Rockefeller Foundation.

[2] Morris Ziff, *Proc. Soc. Exp. Biol. and Med.*, 51: 249, 1942. Since this manuscript was submitted for publication, a second paper by Morris Ziff; *Jour. Biol. Chem.*, 153: 25, 1944, has appeared. Our findings regarding the effects of oxidation and reduction on the alkaline activity are confirmed and extended.

[3] E. S. Guzman Barron and T. P. Singer, SCIENCE, 97: 356, 1943.

[4] Jesse P. Greenstein and John T. Edsall, *Jour. Biol. Chem.*, 133: 397, 1940.

[5] John W. Mehl and Edwin L. Sexton, *Proc. Soc. Exp. Biol. and Med.*, 52: 38, 1943.

by treating with cysteine. The results are given in Table 1, and again suggest that oxidation has a much

TABLE 1

Treatment	Per cent. of initial activity measured at the same pH		
	Myosin 1	Myosin 2	
	Measured at pH 9.2	Measured at pH 9.0	Measured at pH 6.3
0.0075 per cent. H_2O_2 for 15 min. at 22° C.	5	14	49
H_2O_2 as above followed by 0.02 M cysteine for 15 min. at 22° C.	32	49	58

greater effect upon the activity measured in the more alkaline range. When oxidation has taken place, restoration of the activity by reduction takes place to only a small extent for the acid range, but to a substantial extent for the alkaline range.

One might be tempted to look upon the differential effect of oxidation and reduction as evidence for two types of enzyme in the myosin preparations. However, we have been unable to obtain any evidence for fractionation by precipitation at high or low salt concentrations. The failure of attempts to separate the activity from myosin has also been reported by Bailey.[6] The possibility that a different type of functional group in the same molecule or micelle may be primarily responsible for enzymatic activity in each of the pH ranges also suggests itself. Most studies of this enzyme have been made in the pH ranges around 8.5 to 9.5. As the pH is reduced the activity declines and then rises again in the region between 7.5 and 6.5. Although the activity is only about half as great as that at the alkaline optimum, it is this pH which may be expected to be found in the intact muscle. The present studies indicate that the behavior of the enzyme may differ qualitatively as well as quantitatively in the two pH ranges. Whatever the ultimate explanation may be, these experiments do indicate the need for particular attention to pH effects in considering the *in vivo* action of muscle ATP-ase.

JOHN W. MEHL

UNIVERSITY OF SOUTHERN CALIFORNIA
SCHOOL OF MEDICINE, LABORATORIES
OF THE ALLAN HANCOCK FOUNDATION

STUDIES ON THE PERIPHERAL BLOOD IN PATIENTS WITH THERMAL BURNS. 1. THROMBOCYTOPENIA[1, 2, 3]

THE blood platelets, counted by a direct method,[4] were followed on 13 patients with thermal burns.

The patients ranged in age from 4 to 81 years; 5 were males and 8 females. The total area of body surface burned varied from 10 to 75 per cent. and in 9 of the 13 patients was 25 per cent. or more. Third-degree burn was present in all. In 9 cases 20 per cent. or more of the body surface was involved with a third-degree burn.

Surface treatment in most cases was petroleum jelly dressings, often with pressure dressings or plaster casts. One patient was treated with tannic acid and silver nitrate, and one with "triple dye."

Shock was present in 6 cases; in 2 it was slight and in 4 moderate. All the patients received citrated plasma. The administration of large amounts of citrated plasma to normal subjects did not cause a thrombocytopenia.

Hemoglobinemia was present for varying periods of time in all the 13 patients.

For purposes of analysis, platelet counts below 150,000 per cu. mm were considered decreased. In 10 patients the initial platelet count a few hours after burn was above this level. In 3 cases the first platelet count, obtained 9, 38 and 72 hours after the burn, was already below 150,000 per cu. mm.

No decrease in platelets was observed in one patient, who died 7 hours after the burn. He was a 75-year-old man with 15 per cent. of his body surface involved, of which 5 per cent. was a third-degree burn.

In 12 cases, a decreased platelet count was observed 7 to 57 hours after the burn. The lowest counts obtained occurred within 23 to 96 hours after injury and ranged from 9,000 to 96,000 per cu. mm. Six of these patients died within 4 days after the injury, and in these cases the thrombocytopenia persisted until death. In the remaining six, the platelets returned to a normal level in from 4 to 9 days. However, death occurred subsequently in all but one case. This patient is living and apparently completely recovered, fifteen months after injury.

Purpura was observed in 2 patients. In one case petechiae and ecchymoses were widespread.

The cause of the thrombocytopenia and its possible role in the complication of burns is at present under investigation.

A. H. MACDONALD
S. M. LEVENSON
C. S. DAVIDSON
H. J. TAGNON
F. H. L. TAYLOR

[6] Kenneth Bailey, *Biochem. Jour.*, 36: 121, 1942.

[1] From the Thorndike Memorial Laboratory, Second and Fourth Medical Services (Harvard) and the Burns Assignment of the Surgical Services of the Boston City Hospital; and the Department of Medicine and Surgery, Harvard Medical School, Boston, Mass.

[2] The work described in this paper was done in part under a contract recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Harvard University.

[3] Read before the meeting of the Burns Committee, Washington, D. C., December 21, 1943.

[4] F. J. Pohle, *Am. Jour. Med. Sci.*, 197: 40–47, 1939.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

USE OF GELATIN IN THE INFLUENZA RED CELL AGGLUTINATION TEST[1]

THE red blood cell agglutination test has greatly facilitated laboratory studies of influenza by simplifying measurements of virus concentrations and antibody levels. A method utilizing the pattern of the cells settling on the bottoms of serological test-tubes as the criterion of agglutination has previously been reported by us.[2] To determine a virus agglutination titer by this technique, 0.5 cc of each two-fold virus dilution was mixed with 0.5 cc of a 1 per cent. solution of normal rabbit serum in saline, to which was then added 0.1 cc of a 0.75 per cent. suspension of washed human type "O" red cells (or chicken cells, if readily available). The inclusion of the 1 per cent. normal rabbit serum prevented the formation of a film of cells on the bottoms of the tubes which interfered with the reading of negatives and controls. It is the purpose of this note to report that a 0.1 per cent. gelatin solution in saline is a satisfactory substitute for the 1 per cent. rabbit serum. A stock solution, which can be made by dissolving the pure gelatin capsules used in pharmaceutical preparations in the proper volume of warmed saline, will keep in the refrigerator for at least one week.

When running agglutination-inhibition titrations on immune serum samples with the technique as reported in our original publication, a constant serum dilution of 1 : 100 was titrated against increasing dilutions of the agglutinating virus. In a few cases the antibody potency of the immune serum at this dilution has been sufficient to inhibit completely the agglutinating action of a 1:10 dilution of virus, the highest concentration used. In such cases the serum may be diluted to 1:200 or 1:400, or further, if necessary, by the addition of 0.1 per cent. gelatin, and retitrated to determine the end-point. From this titration the theoretical end-point of the serum in a 1:100 dilution can be calculated, since we have found that a two-fold increase in serum dilution resulted in a corresponding two-fold increase in the highest virus dilution showing inhibition of agglutination. We have expressed immune serum titers in terms of the fold-difference between the agglutination end-points of the virus-gelatin control titration and the virus-test serum titration.

Summary: A 0.1 per cent. gelatin solution has been found to be a satisfactory substitute for the normal rabbit serum included to facilitate the reading of agglutination in red blood cell tests with influenza virus.

THE PERSONNEL OF U. S. NAVY MEDICAL RESEARCH UNIT NO. 1
BERKELEY, CALIF.

[1] The opinions advanced in this paper are those of the writers and do not represent the official views of the Navy Department.

[2] Personnel of Naval Laboratory Research Unit No. 1, *U. S. Naval Medical Bulletin*, XLI: 114–128, January, 1943.

A SIMPLE PIPETTE HOLDER

IN the course of chemical analyses it is frequently desirable to put pipettes aside for reuse at a later time. Although there are a number of pipette racks on the market, they all involve putting the pipette through several holes with a consequent contamination of the sides of the pipette—for the racks, obviously, can not be chemically cleaned.

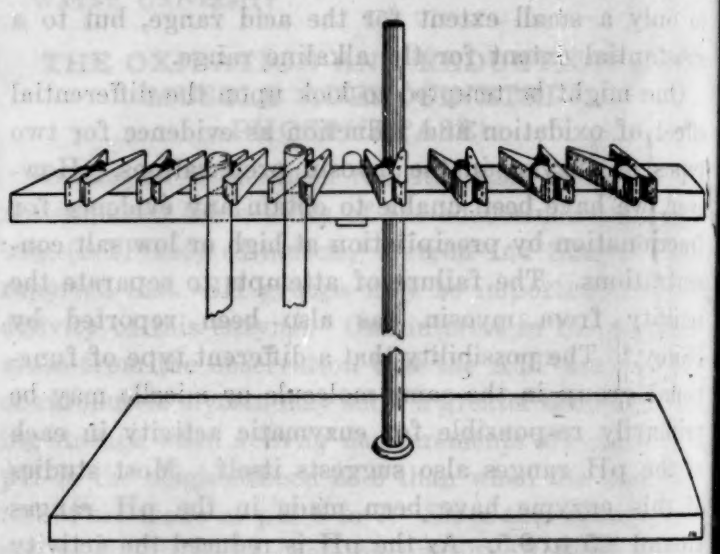

FIG. 1

This pipette holder is made by attaching eight spring type clothes pins to a board, which in turn is attached to a ring stand by a rod and common laboratory clamp. Two nails through one of the sides of the pin serve to attach it to the board. The other side is left free for operating the spring.

ARNOLD LAZAROW
WESTERN RESERVE UNIVERSITY
SCHOOL OF MEDICINE

BOOKS RECEIVED

AUBLE, ROBERT NEIL. *Shop Job Sheets in Radio.* Illustrated. Pp. vii + 128. The Macmillan Company. $1.50.

HARRISON, GEORGE RUSSELL. *Atoms in Action.* Illustrated. Pp. xii + 401. Garden City Publishing Company. $1.49.

RODGERS, ANDREW DENNY. *John Merle Coulter.* Missionary in Science. Pp. viii + 321. Princeton University Press. $3.75.

SUMNER, JAMES B. and G. FRED SOMERS. *Laboratory Experiments in Biological Chemistry.* Illustrated. Pp. vi + 169. Academic Press, Inc. $2.60.

The Philosophy of Bertrand Russell. Edited by PAUL ARTHUR SCHILPP. Pp. xv + 815. Northwestern University. $4.00.

TOKAY, ELBERT. *Fundamentals of Physiology.* Illustrated. Pp. xiv + 336. The New Home Library. 69¢.